

We claim:

1. A display device comprising:

a first array of transparent conductors deposited on a display panel, the first array of transparent conductors having a first pitch defined by a first distance between first adjacent transparent conductors;

a carrier having a plurality of integrated circuit (IC) devices disposed therein is coupled to the display panel; and

a second array of conductors disposed on the plurality of IC devices, the second array of conductors having a second pitch defined by a second distance between second adjacent conductors wherein the first pitch and the second pitch are substantially similar and wherein the first array of transparent conductors interconnect the second array of conductors.

2. A display device as in claim 1 wherein the second array of conductors substantially surrounds a perimeter of each of the plurality of the IC devices.

3. A display device as in claim 1 wherein the second array of conductors interconnect the first array of transparent conductors along at least one edge of the carrier.

4. A display device as in claim 1 wherein the display device has a first length, the carrier has a second length wherein the second length is substantially similar to the first length.

5. A display device as in claim 1 wherein the display is flexible.

6. A display device as in claim 1 wherein the plurality of IC devices are NanoBlocks.
7. A display device as in claim 1 wherein the carrier is flexible.
8. A display device comprising:
  - a top substrate having a first array of transparent conductors;
  - a bottom substrate having a second array of transparent conductors; and
  - a first carrier coupling to the top substrate;
  - a second carrier coupling to the bottom substrate; wherein
    - each of the first carrier and the second carrier includes a plurality of IC devices and a plurality of carrier conducting pads to interconnect the plurality of IC devices to the first array of transparent conductors and the second array of transparent conductors; and
    - wherein each of the plurality of IC device has an array of interconnections which substantially surround a perimeter of each of the plurality of IC devices.
9. A display device as in claim 8 wherein the plurality of carrier conducting pads is aligned along at least one edge of each of the first carrier and the second carrier.
10. A display device as in claim 8 further comprising conductive bonding deposits to couple the first carrier to the top substrate and the second carrier to the bottom substrate.
11. A display device as in claim 10 wherein the conductive bonding deposits are anisotropic conductive films.

12. A display device as in claim 8 wherein the plurality of carrier conducting pads includes signal inputs and signal outputs wherein the signal inputs convey first signals to the plurality IC devices and the signal outputs convey second signals from the plurality of the IC devices to appropriate conductors of the first array of transparent conductors and the second array of transparent conductors.
13. A display device as in claim 12 wherein the first signals include at least one of a power supply signal, a data signal, a clock signal, and a ground signal.
14. A display device as in claim 8 wherein the carrier conducting pads are made out of a conductive material.
15. A display device as in claim 14 wherein the conductive material is selected from a group consisting of aluminum, molybdenum, gold, silver, and copper.
16. A display device as in claim 8 wherein each of the first carrier and the second carrier has a plurality of receptor sites each of which is designed to mate with one of the plurality of IC devices.
17. A display device as in claim 8 wherein each of the plurality of IC devices is coupled to a receptor site such that the plurality of IC devices are embedded below a native surface of the first carrier and the second carrier.

18. A display device as in claim 8 wherein the first carrier and the second carrier are flexible.
19. A display device as in claim 8 wherein the top substrate and the bottom substrate are flexible.
20. A display device as in claim 8 wherein each of the top substrate and the bottom substrate is made out of one of plastic and glass.
21. A display device as in claim 8 wherein the plurality of IC devices includes at least twenty IC devices.
22. A display device as in claim 8 wherein the display has a first pitch defined by a first distance between adjacent transparent conductors of the first array of transparent conductors and the second array of transparent conductors and wherein each of the first carrier and the second carrier has a second pitch defined by a second distance between adjacent interconnections of the plurality of interconnections on each of the plurality of IC devices wherein the first pitch and the second pitch are substantially similar.
23. A display device as in claim 8 wherein the plurality of IC devices includes more than two IC devices that are identical and evenly spaced along the carrier wherein the display has a first pitch defined by a first distance between adjacent transparent conductors of the first array of transparent conductors and the second array of transparent conductors and wherein each of the first carrier and the second carrier has a second pitch defined by a

second distance between adjacent interconnections of the plurality of interconnections on each of the plurality of IC devices wherein the first pitch and the second pitch are substantially similar.

24. A display device as in claim 8 wherein the first carrier is coupled to the top substrate such that a first top surface of the first carrier is brought into a direct contact with the first array of transparent conductors that extend out from the top substrate and wherein the second carrier is coupled to the bottom substrate such that a second top surface of the second carrier is brought into the direct contact with the second array of transparent conductors that extend out from the bottom substrate.

25. A display device as in claim 8 wherein the IC devices are NanoBlocks.

26. A display device as in claim 8 wherein the first array of transparent conductors and the second array of transparent conductors are made out of ITO.

27. A display device as in claim 8 wherein the top substrate and the bottom substrate have a first length and wherein the first carrier and the second carrier have a second length.

28. A display device as in claim 8 wherein the second length is substantially equal to the first length.

29. A display device as in claim 8 wherein the interconnections further include integrated circuit conducting pads, the integrated circuit conducting pads substantially surround a

perimeter of each of the plurality of IC devices and interconnect the plurality of IC devices to the carrier conducting pads.

30. A display device as in claim 8 further comprising a display medium deposited between the top substrate and the bottom substrate.

31. A display device comprising:

- a top substrate having a first array of transparent conductors;

- a bottom substrate having a second array of transparent conductors;

- a first plurality of IC devices and a second plurality of IC devices fabricated onto one of the top substrate or the bottom substrate; and

- a crossover contact area extended from the one of the top substrate and the bottom substrate which has the first plurality of IC devices and the second plurality of IC devices fabricated therein, the crossover contact area includes a plurality of contact conductors which interconnect the second plurality of IC devices to one of the top substrate or the bottom second substrate which does not have the first plurality of IC devices and the second plurality of the IC devices fabricated therein.

32. A flat panel display as in claim 31 further comprising a conductive bonding deposit disposed over the crossover contact area, the conductive bonding deposit electrically interconnects the second plurality of IC devices to one of the top substrate or the bottom substrate which does not have the first plurality of IC devices and the second plurality of the IC devices fabricated therein.

33. A display device as in claim 31 wherein the conductive bonding deposit is an anisotropic conductive film.
34. A display device as in claim 31 wherein the first set of transparent conductors and the second set of transparent conductors are made out of ITO.
35. A display device as in claim 31 wherein the top substrate and the bottom substrate are flexible.
36. A display device as in claim 31 wherein the top substrate and the bottom substrate are made out of one of plastic and glass.
37. A display device as in claim 31 wherein each of the plurality of the IC devices is a NanoBlocks.
38. A display device as in claim 31 wherein each IC device in the first plurality of the IC devices and in the second first plurality of the IC devices includes a plurality of integrated circuit conducting pads which substantially surrounds a perimeter of each of the plurality of the IC devices and which establish necessary interconnections from the IC device.
39. A display device as in claim 38 wherein the necessary interconnections include interconnections from first plurality of the IC devices to the first array of transparent conductors and interconnections from the second plurality of the IC devices to the second array of transparent conductors.

40. A display device as in claim 39 wherein the necessary interconnections are made from more than one side of the IC device.

41. A display device as in claim 31 further comprising a display medium deposited between the top substrate and the bottom substrate.

42. A double-layer structure conductor for use with a display device comprising:

- a substrate including a plurality of IC devices deposited therein;

- a first set of conductors and a second set of conductors separated by an insulation layer, the insulation layer has a plurality of contact vias forming therethrough;

- a plurality of conducting pads locating on a surface of each of the first plurality of the IC devices, wherein

- the plurality of conducting pads interconnect with one of the first set of conductors and the second set of conductors through the plurality of contact vias;

- the first set of conductors and the second set of conductors interconnect with each other through the plurality of contact vias; and

- one of the first set of conductors and the second set of connectors interconnect with an array of transparent conductors in the display device.

43. A double-layer structure conductor for use with a display device as in claim 42 wherein the substrate includes a display area having the array of transparent conductors deposited therein.



44. A double-layer structure conductor for use with a display device as in claim 42 wherein the substrate is a carrier coupling to a display substrate having the array of transparent conductors.
45. A double-layer structure conductor for use with a display device as in claim 44 further comprising a conductive bonding deposit for coupling the carrier to the display substrate having the array of transparent conductors
46. A double-layer structure conductor for use with a display device as in claim 45 wherein the conductive bonding deposit is an anisotropic conductive film.
47. A double-layer structure conductor for use with a display device as in claim 46 wherein the carrier is coupled to the display substrate such that one of the first set of conductors and the second set of conductors on the carrier is in direct contact with the array of transparent conductors.
48. A double-layer structure conductor for use with a display device as in claim 42 wherein first set of conductors is deposited on the bottom surface of the substrate and wherein the substrate further includes another plurality of contact vias wherethrough the first set of conductors interconnect the second set of conductors.

49. A double-layer structure conductor for use with a display device as in claim 42 wherein each IC device of the plurality of IC devices comprises a plurality of integrated circuit conducting pads substantially surrounding a perimeter of the IC device wherein the plurality of integrated circuit conducting pads facilitates interconnections from the IC device to the first set of conductors and the second set of conductors.
50. A double-layer structure conductor for use with a display device as in claim 49 wherein the interconnections are made from more than one sides of the IC device.
51. A display device comprising:
- a top substrate having a first array of transparent conductors;
  - a bottom substrate having a second array of transparent conductors;
  - a carrier having a first plurality of IC devices and a second plurality of IC devices coupling to one of the top substrate and the bottom substrate;
  - a crossover contact area extended from the one of the top substrate and the bottom substrate which has the carrier coupling thereto, the crossover contact area includes a plurality of contact conductors which interconnect the second plurality of IC devices to one of the top substrate and the bottom second substrate which does not have the carrier coupling thereto.
52. A flat panel display as in claim 51 further comprising a conductive bonding deposit disposed over the crossover contact area, the conductive bonding deposit electrically interconnects the second plurality of IC devices to one of the top substrate and the bottom substrate which does not have the carrier coupling thereto.

53. A display device as in claim 51 wherein the conductive bonding deposit is an anisotropic conductive film.
54. A display device as in claim 51 wherein the first set of transparent conductors and the second set of transparent conductors are made out of ITO.
55. A display device as in claim 51 wherein the top substrate and the bottom substrate are flexible.
56. A display device as in claim 51 wherein the top substrate and the bottom substrate are made out of one of plastic and glass.
57. A display device as in claim 51 wherein each of the plurality of the IC devices is a NanoBlocks.
58. A display device as in claim 51 wherein each IC device in the first plurality of the IC devices and in the second first plurality of the IC devices includes a plurality of integrated circuit conducting pads which substantially surrounds a perimeter of each of the plurality of the IC devices and which establish necessary interconnections from the each IC device.
59. A display device as in claim 58 wherein the necessary interconnections include interconnections from first plurality of the IC devices to the first array of transparent

conductors and interconnections from the second plurality of the IC devices to the second array of transparent conductors.

60. A display device as in claim 59 wherein the necessary interconnections are made from more than one side of the each IC device.

61. A display device as in claim 51 further comprising a display medium deposited between the top substrate and the bottom substrate.

62. A method of making a display device comprising:

coupling a carrier having a plurality of integrated circuit (IC) devices disposed therein to a display panel, the display panel comprising a first array of transparent conductors having a first pitch defined by a first distance between first adjacent transparent conductors, the plurality of IC devices comprising a second array of conductors disposed thereon, the second array of conductors having a second pitch defined by a second distance between second adjacent conductors, wherein the first pitch and the second pitch are substantially similar; and

interconnecting the first array of transparent conductors to the second array of conductors.

63. A method of making a display device as in claim 62 wherein the second array of conductors substantially surrounds a perimeter of each of the plurality of the IC devices.

64. A method of making a display device as in claim 62 wherein the second array of conductors interconnect the first array of transparent conductors along at least one edge of the carrier.

65. A method of making a display device comprising:

coupling a first carrier to a top substrate having a first array of transparent conductors;  
coupling a second carrier to a bottom substrate having a second array of transparent conductors; wherein

each of the first carrier and the second carrier includes a plurality of IC devices and a plurality of carrier conducting pads which interconnects the plurality of IC devices to the first array of transparent conductors and the second array of transparent conductors; and

each of the plurality of IC device has an array of interconnections which substantially surround a perimeter of each of the plurality of IC devices.

66. A display device as in claim 65 comprising placing the plurality of carrier conducting pads along at least one edge of each of the first carrier and the second carrier.

67. A method of making a display device as in claim 65 comprising adhering the first carrier to the top substrate and adhering the second carrier to the bottom substrate using conductive bonding deposits.

68. A method of making a display device as in claim 62 comprising depositing a display medium between the top substrate and the bottom substrate.

69. A method of making a display device comprising:

coupling a first plurality of IC devices and a second plurality of IC devices to a bottom substrate; and

forming a crossover contact area in the bottom substrate, the crossover contact area includes a plurality of contact conductors which interconnects the second plurality of IC devices to a top substrate; wherein

the top substrate includes a first array of transparent conductors and the bottom substrate includes a second array of transparent conductors.

70. A method of making a display device as in claim 69 wherein the crossover contact area is an extension of the bottom substrate.

71. A method of making a display device comprising:

coupling a first plurality of IC devices and a second plurality of IC devices to a carrier which is coupled to a bottom substrate;

forming a crossover contact area in the bottom substrate, the crossover contact area includes a plurality of contact conductors which interconnects the second plurality of IC devices to a top substrate; wherein

the top substrate includes a first array of transparent conductors and the bottom substrate includes a second array of transparent conductors.

72. A method of making a display device as in claim 71 wherein the crossover contact area is an extension of the bottom substrate.

73. A flat panel display as in claim 71 further comprising disposing a conductive bonding deposit over the crossover contact area, the conductive bonding deposit electrically interconnects the second plurality of IC devices to one of the top substrate and the bottom substrate.

74. A display device as in claim 71 further comprising depositing a display medium between the top substrate and the bottom substrate.

75. A method of making a display device comprising:

disposing a first set of conductors and a second set of conductors separated by an insulation layer on a substrate, the substrate includes a plurality of IC devices deposited therein, the insulation layer has a plurality of contact vias forming therethrough, and each IC devices of the plurality of IC devices includes a plurality of conducting pads on a surface of the IC devices;

interconnecting the plurality of conducting pads to one of the first set of conductors and the second set of conductors through the plurality of contact vias;

interconnecting the first set of conductors to the second set of conductors through the plurality of contact vias; and

interconnecting one of the first set of conductors and the second set of connectors interconnect to an array of transparent conductors in the display devices.

76. A method of making a display device as in claim 75 wherein the substrate is a carrier coupling to a display substrate having the array of transparent conductors.

77. A method of making a display device as in claim 75 wherein the substrate includes the array of transparent conductors.